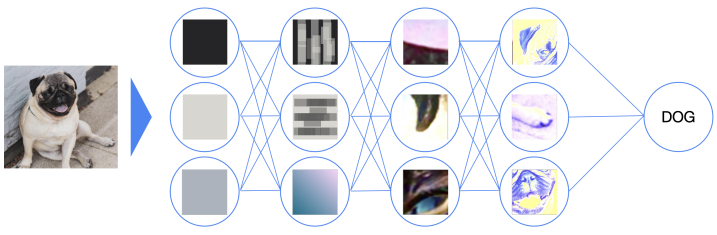
Introduction to Machine Learning

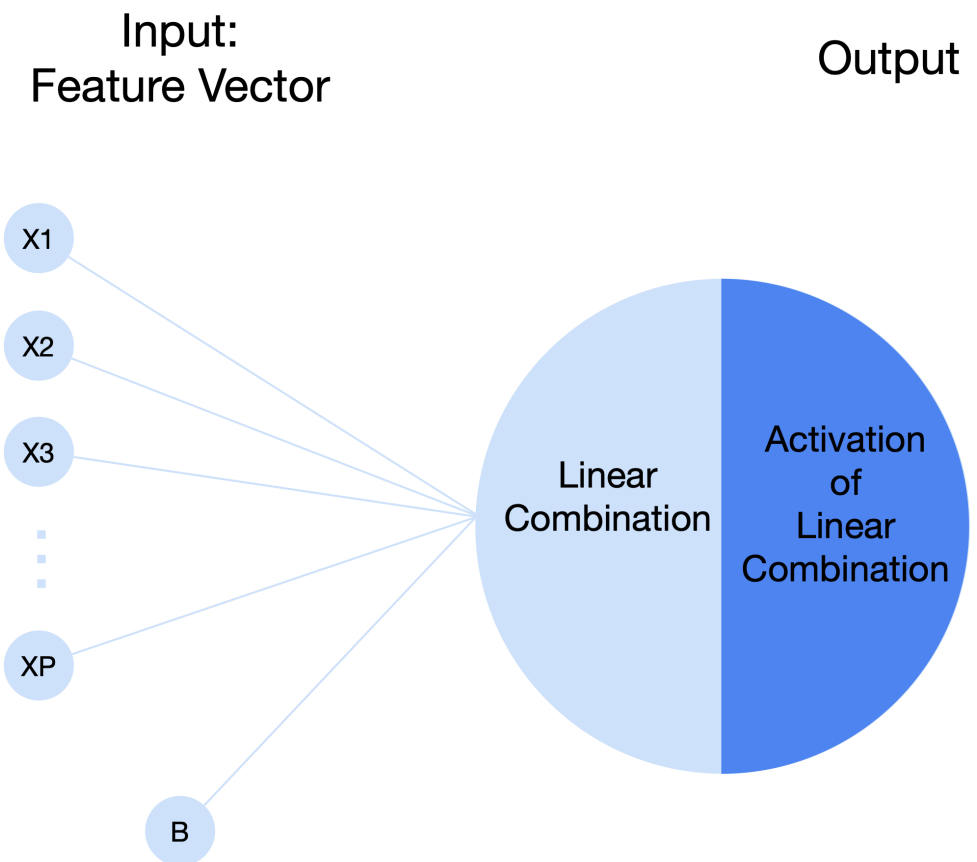
Neural Networks: In a Nutshell



Learning goals

- Know basic computational unit
- Know basic architecture
- Understand Learning in NNs

BASIC COMPUTATIONAL UNIT: PERCEPTRON

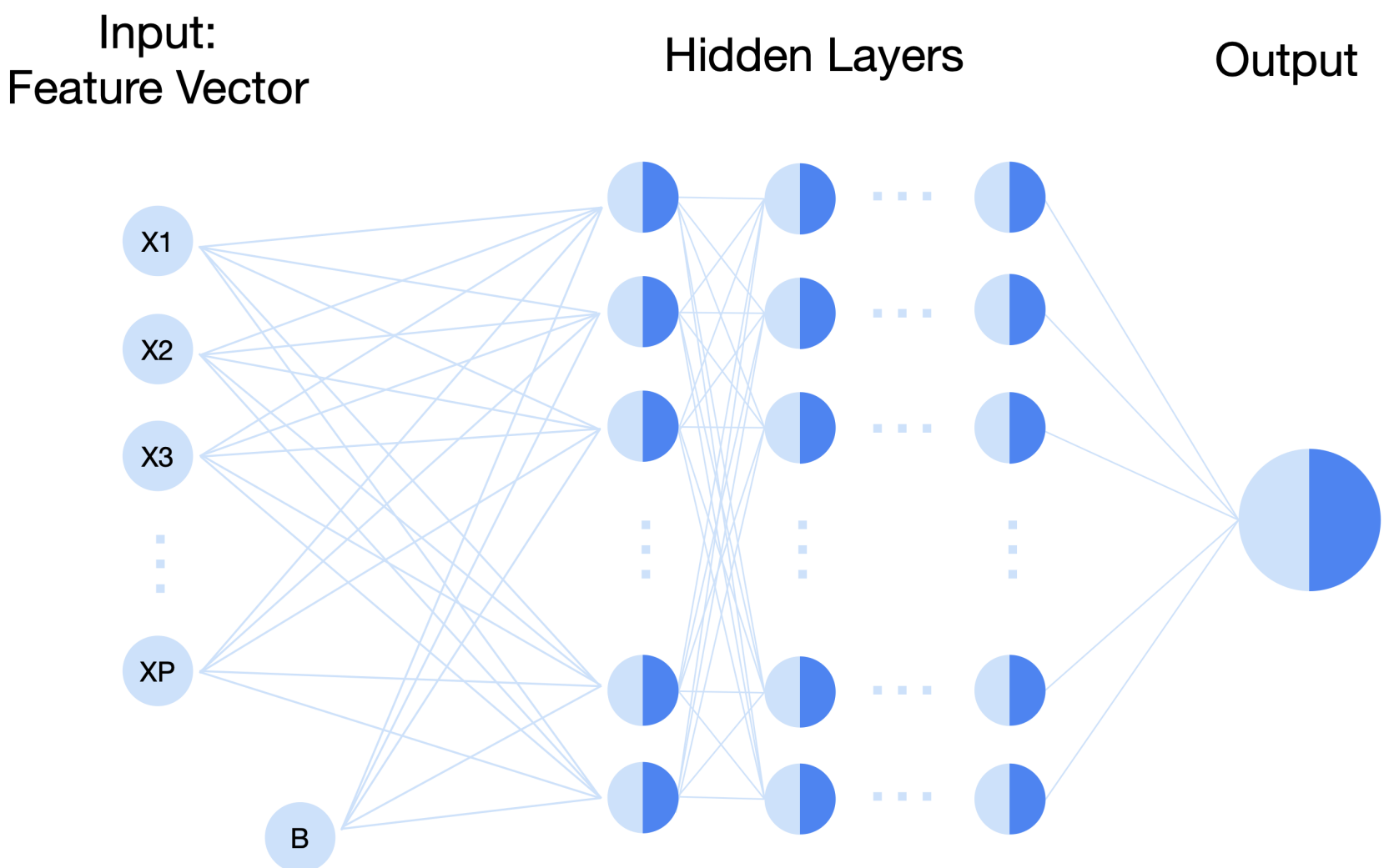


Output differs depending on activation function:

- **Identity function**: Perceptron represents linear regression
- **Logistic function**: Perceptron represents logistic regression
- Other activation functions possible

BASIC ARCHITECTURE OF NN

A neural network is built by combination of multiple perceptrons:



BASIC ARCHITECTURE OF NN

Hidden Layers:

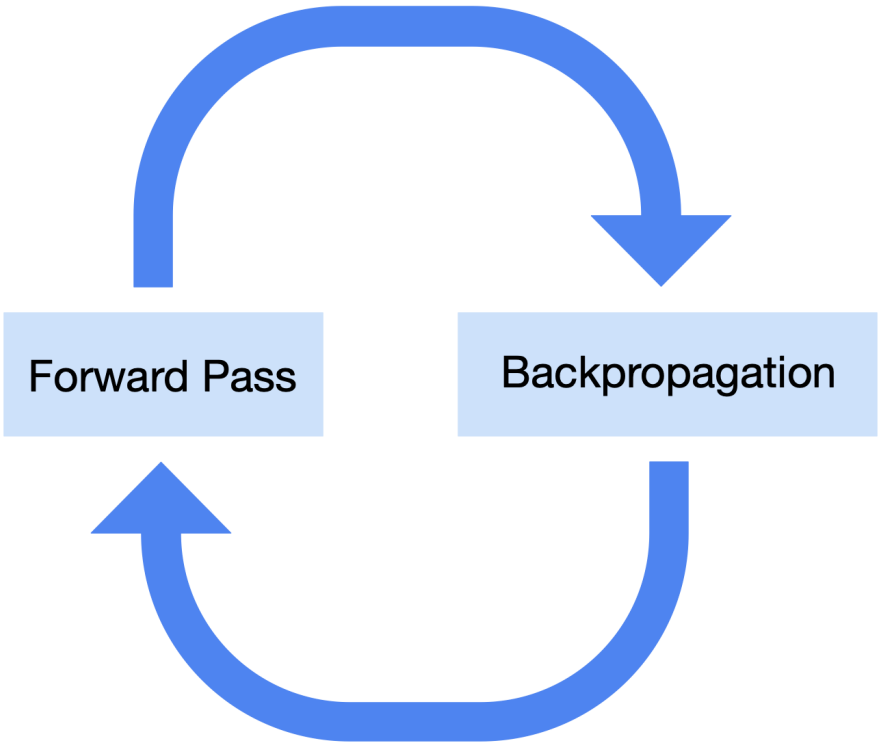
- Output of hidden units serves as input for units in subsequent layers
- Too many hidden layers or too many units per layer lead to overfitting

Output Layer:

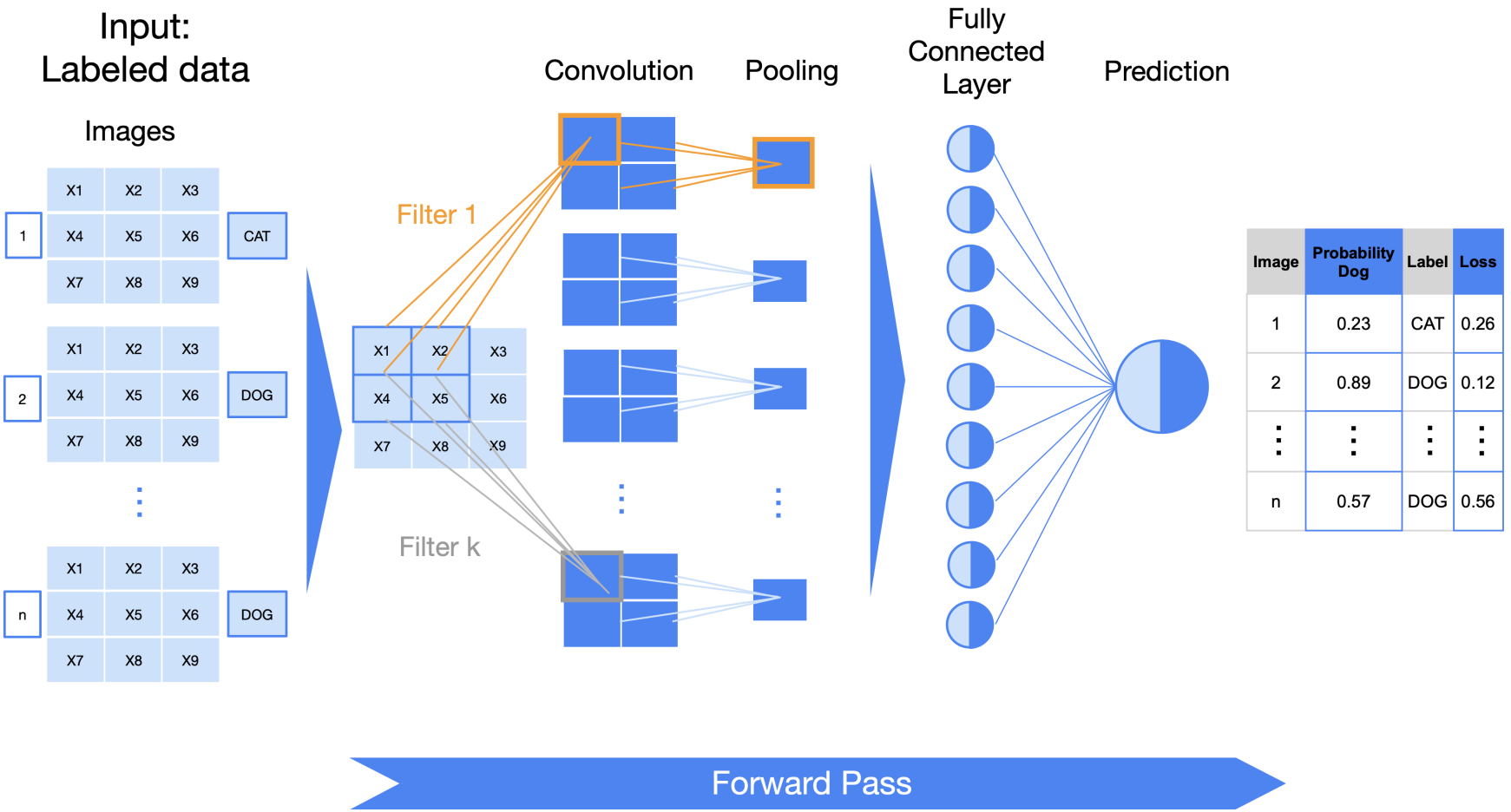
- Number of output units depend on task
- Different activation functions for output layer and hidden layers possible

LEARNING - IMAGE CLASSIFICATION TASK

For each Training Iteration:

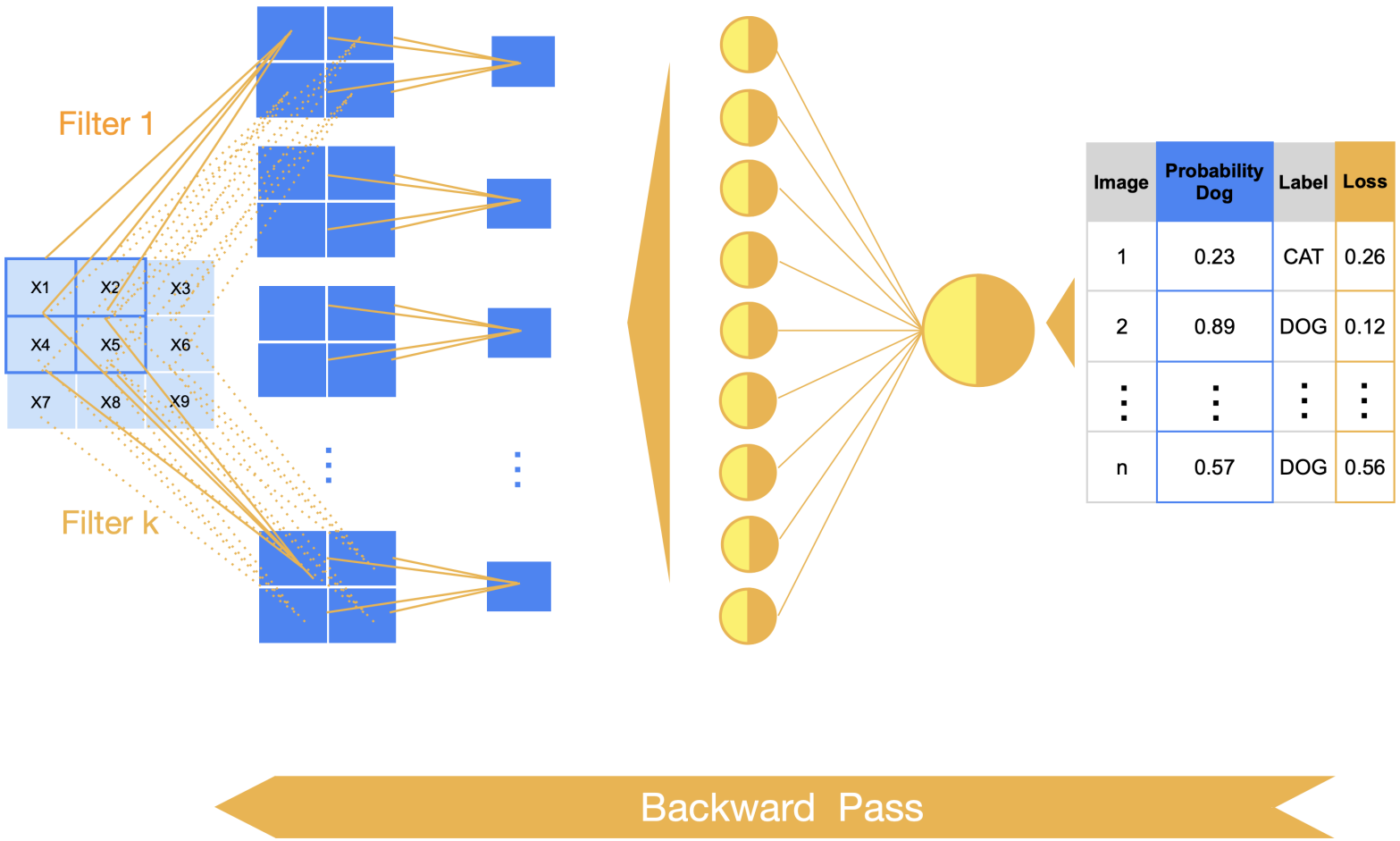


LEARNING - IMAGE CLASSIFICATION TASK

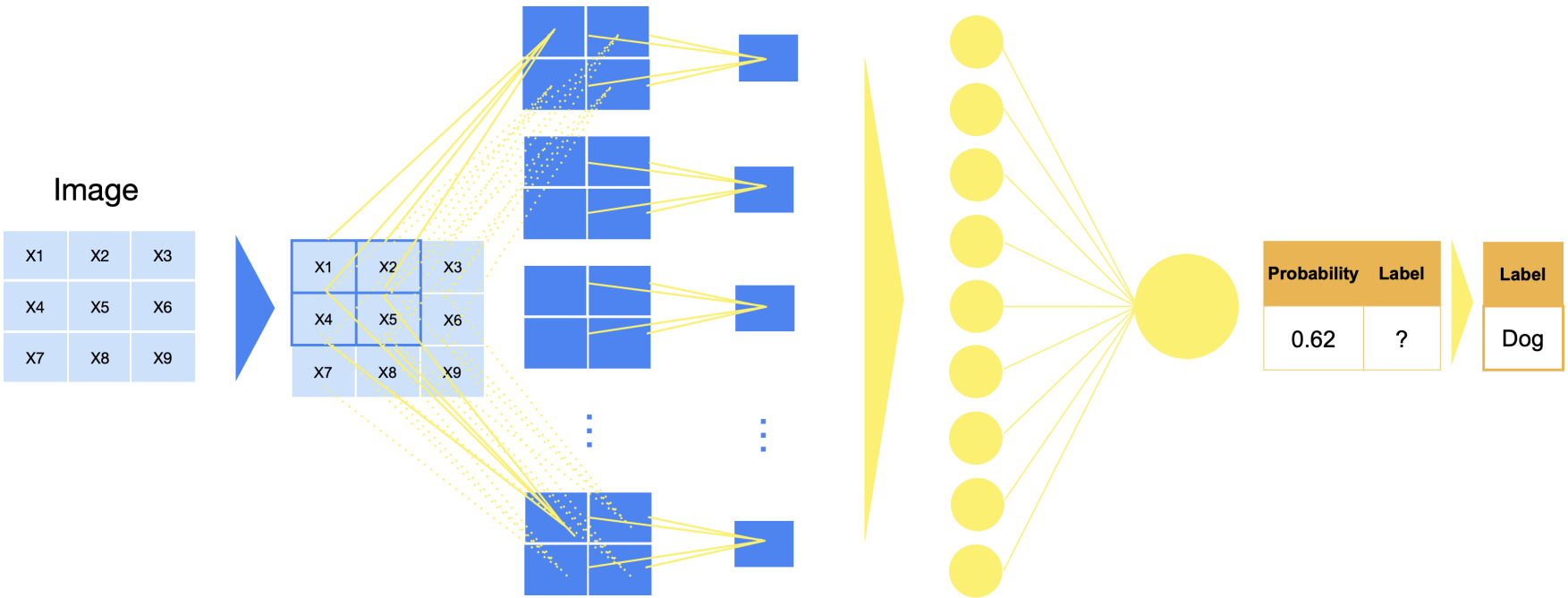


LEARNING - IMAGE CLASSIFICATION TASK

Compute update of each weight by backpropagation



PREDICTION - IMAGE CLASSIFICATION TASK



EFFECT OF HIDDEN LAYERS

- Learn more and more abstract representations
- Each layer adds degree of non-linearity